Chapter 2

Differences in mortality between groups of older migrants and older non-migrants in Belgium, 2001 to 2009

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Abstract: European societies are rapidly ageing and becoming multicultural. We studied differences in overall and cause-specific mortality between migrants and non-migrants in Belgium specifically focusing on the older population. We performed a mortality follow-up until 2009 of the population aged 50 and over living in Flanders and the Brussels-Capital Region by linking the 2001 census data with the population and mortality registers. Overall mortality differences were analysed via directly age-standardised mortality rates. Cause-specific mortality differences between non-migrants and various western and non-western migrant groups were analysed using Poisson regression models, controlling for age (model 1) and additionally controlling for socio-economic status and urban typology (model 2). At older ages, most migrants had an overall mortality advantage relative to non-migrants, regardless of a lower socio-economic status. Specific migrant groups (e.g. Turkish migrants, French and eastern European male migrants, and German female migrants) had an overall mortality disadvantage, which was, at least partially, attributable to a lower socio-economic status. Despite the general overall mortality advantage, migrants experienced higher mortality from infectious diseases, diabetes-related causes, respiratory diseases (western migrants), cardiovascular diseases (non-western female migrants), and lung cancer (western female migrants). Mortality differences between older migrants and non-migrants depend on cause of death, age, sex, migrant origin, and socio-economic status. These differences can be related to lifestyle, social networks, and health care use. Policies aimed at reducing mortality inequalities between older migrants and non-migrants should address the specific health needs of the various migrant groups, as well as socio-economic disparities.

Keywords: mortality, cause of death, migration, ageing, Belgium

2.1 INTRODUCTION

The study of mortality differences between older migrants and non-migrants in Europe is important for a number of reasons. Health is a universal human right, irrespective of nationality or migrant status (International Organization for Migration, 2013). Accordingly, the European Parliament encourages EU member states to tackle health inequalities, including those between migrants and non-migrants (European Union, 2012). This becomes even more relevant in a context where European societies are becoming older and more multicultural (Lanzieri, 2011).

Previous studies on all-cause mortality differences between migrants and non-migrants mainly focused on the total or younger adult population. These studies found that migrants in Europe often have an overall mortality advantage relative to non-migrants, despite generally having a lower socio-economic status, which is known as the 'migrant mortality paradox' (Razum et al., 1998; Abraído-Lanza et al., 1999; Palloni & Arias, 2004).

However, relative mortality differences between migrants and non-migrants vary by country of residence, migrant origin, sex, and age (Agyemang et al., 2012). Since non-migrants' mortality differs across countries (Bhopal et al., 2012), relative mortality inequalities cannot be strictly compared. However, similar relative positioning may indicate 'country of origin' effects. While in France most migrant groups had a mortality advantage over non-migrants (Boulogne et al., 2012), in England and Wales most migrant groups experienced higher mortality than non-migrants (Landman & Cruickshank, 2001). In the Netherlands, mortality was higher among most male migrant groups compared with non-migrants, while differences were not statistically significant among females (Bos et al., 2004). In Belgium, adults from southern Europe, Morocco, and Turkey had lower mortality risks than non-migrants, while French males and sub-Saharan females experienced higher risks (Deboosere & Gadeyne, 2005). Compared to the non-migrant population, most migrant groups in France and the Netherlands were reported to have higher mortality at younger ages, but lower mortality at older ages (Uitenbroek & Verhoeff, 2002; Bos et al., 2004; Boulogne et al., 2012).

Previous studies showed that the overall mortality advantage of migrants could only be partially explained by positive health selection—i.e., the fact that predominantly young and healthy people migrate (Razum et al., 1998; Abraído-Lanza et al., 1999; Uitenbroek & Verhoeff, 2002). Furthermore, this selection effect wears

off with length of stay (Vandenheede et al., 2015). Negative health selection—i.e., the return of unhealthy migrants to their country of origin—appears to be an unlikely explanation in Europe (Razum et al., 1998; Abraído-Lanza et al., 1999; Vandenheede et al., 2015). Therefore, mortality differences between older migrants and non-migrants must be attributable to other mechanisms, such as health-related lifestyles (Abraído-Lanza et al., 2005), social and migrant networks (de Valk et al., 2011), and health care use (Nørredam & Krasnik, 2011), which often change in a migration context (Marmot et al., 1984). The analysis of cause-specific mortality differences enables to disentangle some of these mechanisms via specific risk profiles related to specific causes of death.

Previous studies on relative cause-specific mortality differences showed that most migrants, especially those of non-western origin, had excess mortality from infectious diseases, diabetes, and homicide; and low mortality from all cancers combined (Landman & Cruickshank, 2001; Singh & Siahpush, 2001; Bos et al., 2004; Deboosere & Gadeyne, 2005; Boulogne et al., 2012; Vandenheede et al., 2015). Cardiovascular and cerebrovascular disease mortality tends to be high among migrants from eastern Europe, South Asia, the Caribbean, and sub-Saharan Africa; and low among migrants from Morocco and Turkey (Landman & Cruickshank, 2001; Bos et al., 2004; Deboosere & Gadeyne, 2005; Boulogne et al., 2012).

To our knowledge, no study so far analysed relative cause-specific mortality differences between migrants and non-migrants specifically focusing on the older population. Our aim is therefore to analyse overall and cause-specific mortality differences between different groups of older migrants and non-migrants.

We performed our analysis in Belgium, one of the forerunners in Europe in the transition to an older and more multicultural society. Furthermore, Belgium currently has a larger proportion of older migrants than other traditional European immigration countries, such as Germany, the United Kingdom, and the Netherlands (de Valk et al., 2011).

2.2 METHODS

We studied first-generation migrants and non-migrants aged 50 years and older living in Flanders and the Brussels-Capital Region at the time of the 2001 census. We performed a mortality follow-up of these individuals until 2009. The final

population included in the analyses was 2,356,122, of whom 92.3% were non-migrants and 7.7% were migrants.

We defined migrants as individuals born outside Belgium and with a foreign nationality at birth. We classified migrants according to their nationality at birth into two main groups: western and non-western (Vandenheede et al., 2015). We additionally distinguished more specific migrant groups, including the main nationalities of older migrants in Belgium: Dutch, French, German, Moroccan, and Turkish migrants; southern European migrants, grouped together since most of them had arrived as 'guest workers' (de Valk et al., 2011); and eastern European migrants, grouped together since most of them were political refugees or belonged to ethnic minorities (Jennissen et al., 2006). Second-generation migrants (N = 20,936) were excluded, since their mortality outcomes likely differ from both those of non-migrants and those of first-generation migrants.

Data on age, sex, nationality at birth, education, housing status, and urban typology were derived from the 2001 census. Census data were linked with the population and mortality register data in two steps. First, the census was linked with population register data on emigration and all-cause mortality via a personal ID number (100% linkage). Censored cases consisted of people who left Flanders and the Brussels-Capital Region during the follow-up period. Information on the cause of death was then obtained by linking these data with the mortality register using an identification key (98% of the cases linked).

The classification of the underlying causes of death and the respective ICD-10 codes included in each category are shown in Table 2.1. This classification takes into account the most important causes of death at older ages, the potential risk factors, and ensures comparability with classifications from previous studies (Deboosere & Gadeyne, 2005; Vandenheede et al., 2015).

All of the analyses were performed separately by sex.

We analysed overall mortality differences via direct age-standardised mortality rates (ASMR) over the period 2001–2009 for the different groups of older migrants and non-migrants, considering the total older population in Flanders and the Brussels-Capital Region in 2001 as the standard. We calculated 95% confidence intervals (CI) for the ASMR as detailed by Curtin & Klein (1995).

Table 2.1. Selected cause of death groups with International classification of diseases (ICD) codes

Cause of death	ICD-10
Infectious diseases	A00-B99
Neoplasms (all)	C00-D48
Lung cancer	C33-C34
Breast cancer	C50
Prostate cancer	C61
Cardiovascular diseases (all)	I00-I99
Ischaemic heart disease	I20-I25
Heart failure	I50
Cerebrovascular disease	I60-I69
Respiratory diseases	J00-J99
Diabetes mellitus	E10-E14
Alcohol-related mortality	F10, G31.2, G62.1, I42.6, K29.2, K70, K73, K74.0-K74.2, K74.6, K86.0, X45, X65, Y15
External causes (all)	V00-Y84
Suicide	X60-X84, Y87
Symptoms and ill-defined conditions	R00-R99

The analysis of cause-specific mortality differences required us to weight our data. While it was possible to link the census and register data with the mortality register data for 98% of the population, the proportion of unlinked cases was considerably higher for some migrant groups (Table 2.2). We calculated simple ratio weights (Fawcett et al., 2002) based on sex, age, nationality at birth, education, and urban typology for those who died during the interval. We calculated ASMR for the different causes of death to assess the contribution of each cause of death to the overall ASMR of the different groups of older migrants and non-migrants.

Relative mortality differences over the study period were analysed using weighted Poisson regression models for each cause of death. From these models, we derived mortality rate ratios (MRR) and their 95% CI, for the different groups of older migrants relative to older non-migrants. The natural logarithm of the person-years at risk was included in the models as the offset variable. Model 1 controls for age, whereas model 2 additionally controls for socio-economic status (education and housing status) and urban typology. For this purpose only, we additionally considered the associated and intermediate causes of death for alcohol- and diabetes-attributable mortality, since the effects of alcohol on health

are often underestimated at older ages (Hoeck & van Hal, 2012) and diabetes is often associated with mortality without being the underlying cause (Vandenheede et al., 2013).

Table 2.2. Unlinked deaths by sex and origin group

	Males		Females	
Origin group	**Deaths**	**%**	**Deaths**	**%**
Total population	5,163	2.12	4,888	1.88
Non-migrants	3,704	1.61	3,873	1.58
Migrants	1,459	10.25	1,015	7.06
Western migrants	834	7.54	624	4.98
German migrants	34	5.36	41	2.44
French migrants	107	6.5	118	4.88
Dutch migrants	162	5.28	86	2.84
Southern European migrants	350	11.38	211	9.85
Eastern European migrants	113	7.23	121	5.67
Other western migrants	68	6.34	47	4.18
Non-western migrants	625	19.72	391	21.16
Turkish migrants	199	24.39	128	23.4
Moroccan migrants	340	21.79	200	25.51
Other non-western migrants	86	10.84	63	12.19

Data source: Belgian 2001 census linked to National Register (2001-2009)

Age was defined as a categorical variable in five-year age groups up to 85+. Education consisted of four categories (up to primary, lower secondary, upper secondary, and tertiary education). Housing status was defined as a compound variable including both housing quality and tenure (Vandenheede et al., 2013). Urban typology distinguished between central cities, suburbs, and non-urban municipalities (Luyten & van Hecke, 2007). The unweighted regression results are available in a supplement at the end of this chapter (Tables 2.S.1 and 2.S.2).

2.3 RESULTS

The ASMR of older non-migrants were 31.4 deaths per 1,000 (95% CI 31.3–31.6) for males and 27.7 deaths per 1,000 (27.6–27.8) for females (Table 2.3). Migrants, especially those of non-western origin, tended to have lower mortality than non-migrants. Mortality was particularly low among Moroccan males (ASMR 23.0, 95% CI 21.5–24.5) and females (23.8, 21.4–26.1). In contrast, mortality was

Table 2.3. Age-standardised mortality rates (ASMR) using the total population as the standard, number of deaths and person-years at risk of migrants and non-migrants aged 50+ over the period 2001-2009 (Flanders and Brussels-Capital Region)

	Males				Females			
	ASMR per 1,000	Deaths	Person-years at risk		ASMR per 1,000	Deaths	Person-years at risk	
Origin group	(95% C.I.)		Number	%	(95% C.I.)		Number	%
Total population	31.3 [31.2 - 31.4]	243,739	7,787,938	100.0	27.7 [27.6 - 27.8]	259,385	9,363,546	100.0
Non-migrants	31.4 [31.3 - 31.6]	229,509	7,165,459	92.0	27.7 [27.6 - 27.8]	245,006	8,693,845	92.9
Migrants	29.5 [29.0 - 30.0]	14,230	622,479	8.0	27.2 [26.7 - 27.6]	14,379	669,701	7.1
Western	30.3 [29.7 - 30.8]	11,061	424,727	5.5	27.4 [26.9 - 27.8]	12,531	505,875	5.4
German	30.8 [28.4 - 33.2]	634	26,452	0.3	32.4 [30.8 - 33.9]	1,683	56,097	0.6
French	34.5 [32.8 - 36.1]	1,647	56,402	0.7	28.1 [27.0 - 29.2]	2,418	78,746	0.8
Dutch	27.6 [26.7 - 28.6]	3,067	122,882	1.6	27.0 [26.1 - 28.0]	3,029	134,735	1.4
Southern European [a]	30.7 [29.6 - 31.8]	3,076	136,031	1.8	24.3 [23.2 - 25.4]	2,143	132,091	1.4
Eastern European [b]	33.9 [32.2 - 35.6]	1,564	39,257	0.5	28.8 [27.5 - 30.1]	2,133	58,093	0.6
Other western	27.7 [26.0 - 29.5]	1,073	43,704	0.6	25.5 [24.0 - 27.1]	1,125	46,113	0.5
Non-western	24.6 [23.5 - 25.6]	3,169	197,751	2.5	23.4 [22.0 - 24.7]	1,848	163,826	1.7
Turkish	31.4 [28.5 - 34.3]	816	41,283	0.5	27.4 [24.6 - 30.3]	547	39,544	0.4
Moroccan	23.0 [21.6 - 24.5]	1,560	98,856	1.3	23.8 [21.4 - 26.1]	784	74,066	0.8
Other non-western	22.7 [21.0 - 24.5]	793	57,613	0.7	20.4 [18.4 - 22.4]	517	50,215	0.5

Data source: Belgian 2001 census linked to National Register (2001-2009)

a. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

b. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Yugoslavia, former Czechoslovakia, and former USSR

especially high among French males (34.5, 32.8–36.2) and German females (32.4, 30.8–33.9).

Except for Dutch male migrants and German female migrants, the age-specific mortality rates of migrants were lower or higher than those of non-migrants depending on age. The overall mortality advantage (disadvantage) of most western migrants reflected lower (higher) age-specific mortality rates at 'younger' older ages. Most non-western migrants and southern European migrants also experienced lower age-specific mortality rates than non-migrants among the oldest old.

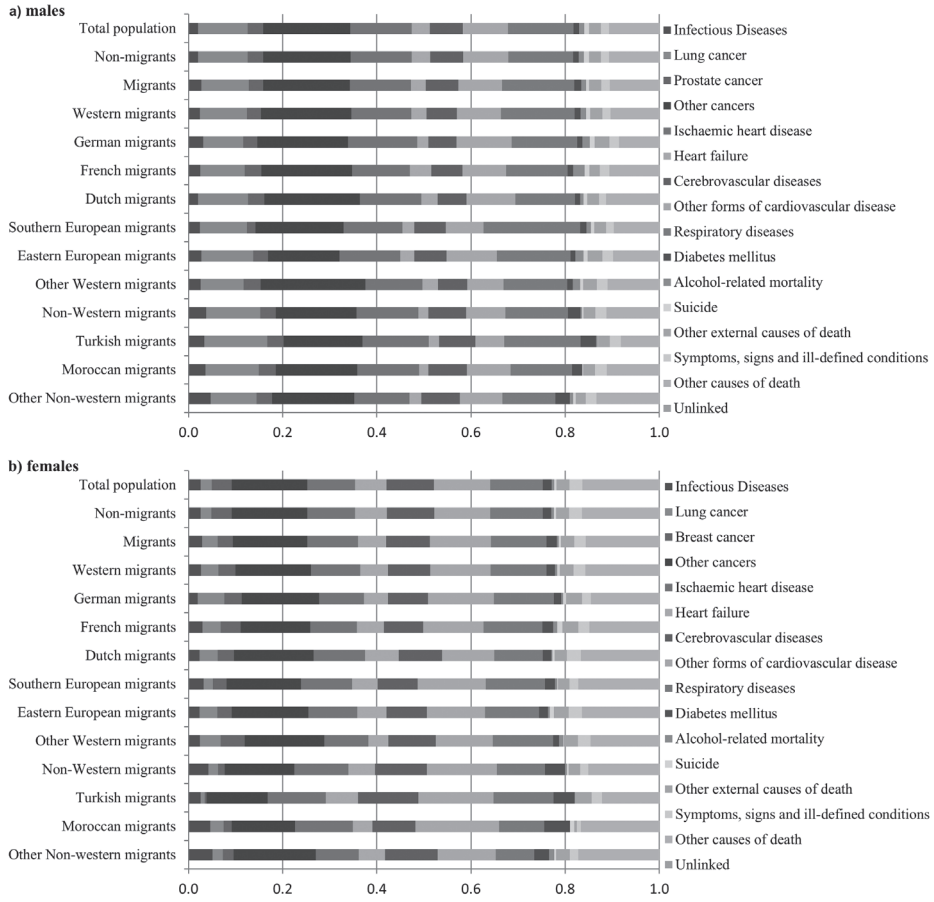
Cancers and cardiovascular diseases made up about two-thirds of all-cause mortality among all groups (Figure 2.1). The proportion of mortality due to respiratory diseases was especially high among southern European male migrants (ca. 20%). The contributions to overall mortality of infectious diseases; diabetes mellitus; external causes of death; alcohol-related causes; and symptoms, signs, and ill-defined conditions were small among all groups.

Older migrants tended to experience an all-cause mortality advantage relative to non-migrants (Tables 2.4 and 2.5). Below we discuss the results for model 2 (controlling for age, socio-economic status, and urban typology) while considering changes with respect to model 1 (controlling for age only).

Controlling for socio-economic status and urban typology diminished the MRR for most causes of death and origin groups, often increasing migrants' mortality advantage. The overall mortality disadvantage of some specific migrant groups was explained by socio-economic status, and even reversed in the case of Turkish male migrants (MRR 0.876, 95% CI 0.817–0.938). After controlling for socio-economic status, the MRR remained high only among German female migrants (1.131, 1.078–1.186).

Among older males, mortality due to cancers, cardiovascular diseases, and external causes of death tended to be lower among migrants, especially those of non-western origin, than among non-migrants. Male migrants, especially those of non-western origin, had higher mortality due to infectious diseases and diabetes-related causes. Diabetes-related mortality was especially high, with a MRR above 1.5 among southern European and non-western male migrants, even after controlling for socio-economic status. Mortality due to respiratory diseases tended to be lower among non-western migrants, but higher among western migrants, especially among southern (1.218, 1.120–1.324) and eastern European male

Figure 2.1. Contribution of the different causes of death to the age-standardised mortality rate at ages 50 and over by sex over the period 2001–2009, according to migrant origin (Flanders and Brussels-Capital Region) [a,b,c]



Data source: Belgian 2001 census linked to National Register (2001-2009)

a. In this figure mortality due to alcohol and diabetes mellitus refers only to the underlying cause of death

b. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

c. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Czechoslovakia, former Yugoslavia, and former USSR

migrants (1.156, 1.024–1.305). Alcohol-related mortality was particularly high among French male migrants (1.339, 1.072–1.673). Suicide (0.179, 0.107–0.299) and alcohol-related mortality (0.179, 0.132–0.243) were very low among non-western male migrants. Finally, in line with the general trend, mortality due to

Table 2.4. Cause-specific mortality rate ratios with 95% confidence intervals for male migrants compared to non-migrants (reference) aged 50+ over the period 2001-2009 (Flanders and Brussels-Capital Region)

	All-cause mortality [a,b]		Cancer (all) [a,b]	
	N = 243,739		N = 76,945	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.958 [0.940-0.976]**	**0.906 [0.889-0.924]**	**0.948 [0.917-0.980]**	**0.906 [0.876-0.937]**
German	0.996 [0.921-1.076]	0.987 [0.913-1.067]	0.927 [0.809-1.062]	0.924 [0.807-1.059]
French	**1.098 [1.046-1.152]**	1.008 [0.960-1.058]	**1.096 [1.006-1.193]**	1.017 [0.934-1.107]
Dutch	**0.873 [0.843-0.905]**	**0.910 [0.878-0.943]**	**0.927 [0.873-0.985]**	0.965 [0.909-1.026]
Southern European [c]	**0.964 [0.930-0.999]**	**0.825 [0.796-0.855]**	**0.911 [0.857-0.968]**	**0.797 [0.750-0.848]**
Eastern European [d]	**1.057 [1.006-1.111]**	0.979 [0.932-1.029]	0.954 [0.867-1.050]	**0.894 [0.812-0.984]**
Non-western	**0.854 [0.825-0.885]**	**0.697 [0.673-0.722]**	**0.790 [0.745-0.837]**	**0.666 [0.628-0.707]**
Turkish	**1.082 [1.010-1.159]**	**0.876 [0.817-0.938]**	1.022 [0.913-1.143]	**0.853 [0.762-0.955]**
Moroccan	**0.815 [0.775-0.857]**	**0.643 [0.611-0.676]**	**0.766 [0.706-0.832]**	**0.625 [0.575-0.679]**
	Lung cancer [a,b]		**Prostate cancer [a,b]**	
	N = 24,986		N = 7,958	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.910 [0.858-0.966]**	**0.870 [0.819-0.923]**	**0.862 [0.771-0.964]**	**0.834 [0.746-0.934]**
German	**0.765 [0.592-0.989]**	0.790 [0.611-1.021]	1.048 [0.681-1.614]	1.025 [0.666-1.579]
French	1.016 [0.870-1.185]	0.928 [0.795-1.084]	1.085 [0.827-1.423]	1.037 [0.791-1.361]
Dutch	**0.875 [0.785-0.975]**	0.951 [0.853-1.060]	0.912 [0.752-1.105]	0.923 [0.761-1.119]
Southern European [c]	0.928 [0.837-1.029]	**0.774 [0.697-0.859]**	**0.552 [0.422-0.721]**	**0.512 [0.391-0.670]**
Eastern European [d]	1.064 [0.905-1.252]	1.006 [0.854-1.184]	1.012 [0.771-1.329]	0.959 [0.730-1.260]
Non-western	**0.880 [0.802-0.967]**	**0.699 [0.636-0.770]**	**0.793 [0.638-0.986]**	**0.719 [0.577-0.896]**
Turkish	**1.239 [1.044-1.470]**	0.949 [0.799-1.127]	0.906 [0.577-1.423]	0.823 [0.524-1.295]
Moroccan	**0.877 [0.771-0.998]**	**0.661 [0.580-0.753]**	0.798 [0.592-1.077]	**0.711 [0.526-0.962]**
	Cardiovascular diseases (all) [a,b]		**Ischaemic heart disease [a,b]**	
	N = 80,037		N = 31,088	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.910 [0.879-0.941]**	**0.877 [0.848-0.908]**	**0.939 [0.890-0.990]**	**0.910 [0.862-0.960]**
German	1.079 [0.945-1.231]	1.085 [0.950-1.238]	1.179 [0.967-1.438]	1.198 [0.983-1.461]
French	1.049 [0.963-1.144]	0.983 [0.902-1.071]	1.024 [0.891-1.177]	0.957 [0.833-1.100]
Dutch	**0.860 [0.808-0.915]**	**0.893 [0.839-0.950]**	**0.876 [0.793-0.966]**	0.918 [0.831-1.013]
Southern European [c]	**0.856 [0.801-0.916]**	**0.757 [0.707-0.810]**	0.926 [0.837-1.024]	**0.821 [0.742-0.908]**
Eastern European [d]	1.040 [0.955-1.133]	0.990 [0.909-1.079]	1.069 [0.932-1.227]	1.025 [0.893-1.176]
Non-western	**0.884 [0.830-0.942]**	**0.748 [0.702-0.797]**	0.915 [0.833-1.006]	**0.776 [0.705-0.853]**
Turkish	**1.151 [1.019-1.300]**	0.960 [0.849-1.085]	**1.328 [1.118-1.578]**	1.103 [0.928-1.311]
Moroccan	**0.847 [0.775-0.926]**	**0.695 [0.636-0.760]**	0.876 [0.766-1.001]	**0.719 [0.628-0.823]**

Table 2.4. (continued)

	Heart failure [a,b]		Cerebrovascular disease [a,b]	
	N = 9,341		N = 16,620	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.793 [0.712-0.883]**	**0.794 [0.712-0.885]**	**0.891 [0.825-0.961]**	**0.871 [0.807-0.941]**
German	0.596 [0.341-1.041]	0.624 [0.357-1.091]	0.883 [0.637-1.223]	0.897 [0.647-1.243]
French	1.255 [0.995-1.581]	1.234 [0.979-1.555]	1.014 [0.836-1.230]	0.973 [0.802-1.180]
Dutch	**0.767 [0.632-0.931]**	**0.795 [0.655-0.965]**	**0.771 [0.667-0.891]**	**0.794 [0.687-0.918]**
Southern European [c]	**0.638 [0.497-0.818]**	**0.593 [0.462-0.762]**	0.919 [0.795-1.062]	**0.839 [0.725-0.971]**
Eastern European [d]	0.808 [0.617-1.057]	0.813 [0.621-1.065]	1.021 [0.847-1.231]	0.995 [0.824-1.200]
Non-western	**0.614 [0.473-0.796]**	**0.556 [0.428-0.722]**	1.093 [0.960-1.243]	0.962 [0.844-1.097]
Turkish	0.866 [0.524-1.432]	0.763 [0.461-1.262]	1.297 [0.997-1.688]	1.125 [0.864-1.465]
Moroccan	**0.525 [0.353-0.781]**	**0.461 [0.309-0.687]**	1.050 [0.874-1.260]	0.906 [0.753-1.089]
	Infectious diseases [a,b]		**Respiratory diseases [a,b]**	
	N = 4,898		N = 33,130	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**1.149 [1.015-1.301]**	1.024 [0.903-1.161]	**1.093 [1.040-1.148]**	1.045 [0.994-1.098]
German	1.489 [0.942-2.354]	1.404 [0.888-2.220]	0.986 [0.790-1.231]	1.023 [0.819-1.278]
French	1.311 [0.958-1.795]	1.135 [0.829-1.555]	1.068 [0.934-1.222]	0.989 [0.864-1.131]
Dutch	0.851 [0.660-1.099]	0.883 [0.683-1.140]	**0.800 [0.723-0.885]**	**0.866 [0.783-0.959]**
Southern European [c]	1.217 [0.968-1.528]	0.956 [0.759-1.203]	**1.482 [1.365-1.610]**	**1.218 [1.120-1.324]**
Eastern European [d]	**1.393 [1.030-1.884]**	1.177 [0.869-1.594]	**1.232 [1.092-1.389]**	**1.156 [1.024-1.305]**
Non-western	**1.667 [1.384-2.009]**	**1.222 [1.010-1.478]**	**0.864 [0.778-0.960]**	**0.663 [0.596-0.737]**
Turkish	1.234 [0.767-1.987]	0.921 [0.571-1.484]	**1.247 [1.025-1.517]**	0.932 [0.766-1.135]
Moroccan	**1.569 [1.203-2.047]**	1.108 [0.846-1.451]	**0.807 [0.694-0.940]**	**0.590 [0.506-0.687]**
	Diabetes-related causes [a,b]		**Alcohol-related causes [a,b]**	
	N = 11,849		N = 5,241	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**1.152 [1.064-1.248]**	1.025 [0.945-1.111]	1.027 [0.915-1.153]	**0.766 [0.681-0.861]**
German	0.830 [0.564-1.223]	0.793 [0.538-1.168]	1.280 [0.857-1.912]	0.991 [0.663-1.481]
French	**1.372 [1.124-1.673]**	1.170 [0.959-1.428]	**2.028 [1.625-2.531]**	**1.339 [1.072-1.673]**
Dutch	**0.695 [0.580-0.833]**	**0.733 [0.611-0.879]**	**0.559 [0.421-0.742]**	**0.562 [0.423-0.746]**
Southern European [c]	**1.727 [1.530-1.950]**	**1.336 [1.181-1.510]**	**0.766 [0.608-0.965]**	**0.501 [0.397-0.632]**
Eastern European [d]	**1.322 [1.079-1.620]**	1.123 [0.915-1.377]	**1.653 [1.233-2.215]**	1.104 [0.823-1.481]
Non-western	**2.038 [1.835-2.263]**	**1.441 [1.294-1.605]**	**0.302 [0.223-0.409]**	**0.179 [0.132-0.243]**
Turkish	**2.481 [2.018-3.052]**	**1.782 [1.447-2.195]**	**0.241 [0.115-0.506]**	**0.156 [0.074-0.327]**
Moroccan	**1.980 [1.712-2.291]**	**1.358 [1.171-1.576]**	**0.136 [0.072-0.257]**	**0.079 [0.042-0.150]**

Table 2.4. (continued)

	External causes of death (all) [a,b]		Suicide [a,b]	
	N = 8,567		N = 2,560	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.890 [0.804-0.984]**	**0.813 [0.734-0.900]**	**0.705 [0.578-0.859]**	**0.649 [0.531-0.792]**
German	1.120 [0.778-1.614]	1.070 [0.743-1.542]	1.128 [0.606-2.103]	1.089 [0.584-2.031]
French	1.000 [0.775-1.291]	0.864 [0.670-1.116]	0.953 [0.602-1.506]	0.827 [0.522-1.309]
Dutch	**0.796 [0.658-0.964]**	0.836 [0.690-1.013]	**0.651 [0.447-0.947]**	**0.682 [0.468-0.994]**
Southern European [c]	**0.803 [0.662-0.974]**	**0.654 [0.538-0.795]**	**0.603 [0.414-0.880]**	**0.498 [0.340-0.728]**
Eastern European [d]	1.154 [0.893-1.491]	1.017 [0.786-1.316]	0.801 [0.448-1.430]	0.727 [0.406-1.301]
Non-western	**0.602 [0.496-0.732]**	**0.464 [0.381-0.565]**	**0.229 [0.137-0.382]**	**0.179 [0.107-0.299]**
Turkish	**0.640 [0.423-0.968]**	**0.492 [0.325-0.746]**	**0.159 [0.042-0.609]**	**0.122 [0.032-0.465]**
Moroccan	**0.630 [0.482-0.823]**	**0.466 [0.356-0.611]**	**0.162 [0.068-0.382]**	**0.121 [0.051-0.287]**
	Symptoms, signs and ill-defined conditions [a,b]		**Other causes of death [a,b]**	
	N = 4,134		N = 25,432	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.996 [0.863-1.148]	**0.846 [0.732-0.977]**	**0.929 [0.875-0.986]**	**0.864 [0.813-0.918]**
German	0.832 [0.429-1.613]	0.748 [0.385-1.451]	0.787 [0.595-1.040]	0.757 [0.573-1.001]
French	1.322 [0.947-1.846]	1.073 [0.768-1.499]	1.118 [0.964-1.297]	1.020 [0.879-1.183]
Dutch	0.787 [0.592-1.045]	0.822 [0.619-1.093]	0.920 [0.826-1.024]	0.935 [0.839-1.041]
Southern European [c]	0.952 [0.719-1.261]	**0.677 [0.510-0.899]**	0.892 [0.792-1.004]	**0.758 [0.672-0.854]**
Eastern European [d]	1.281 [0.914-1.796]	1.020 [0.727-1.431]	0.971 [0.832-1.134]	0.871 [0.746-1.018]
Non-western	1.008 [0.781-1.301]	**0.648 [0.500-0.839]**	**0.869 [0.773-0.977]**	**0.711 [0.632-0.800]**
Turkish	0.776 [0.407-1.478]	**0.517 [0.271-0.985]**	0.971 [0.760-1.242]	0.798 [0.624-1.021]
Moroccan	1.093 [0.775-1.541]	**0.669 [0.473-0.946]**	**0.819 [0.693-0.968]**	**0.651 [0.550-0.771]**

Data source: Belgian 2001 census linked to National Register (2001-2009)

a. Model 1: Controlling for age; Model 2: Controlling for age, education, housing status, and urban typology

b. In bold, statistically significant ($p < 0.05$)

c. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

d. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Czechoslovakia, former Yugoslavia, and former USSR

Table 2.5. Cause-specific mortality rate ratios with 95% confidence intervals for female migrants compared to non-migrants (reference) aged 50+ over the period 2001-2009 (Flanders and Brussels-Capital Region)

	All-cause mortality [a,b]		Cancer (all) [a,b]	
	N = 259,385		N = 57,472	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.989 [0.971-1.007]	**0.948 [0.931-0.965]**	1.016 [0.979-1.053]	**0.963 [0.928-0.999]**
German	**1.183 [1.127-1.241]**	**1.131 [1.078-1.186]**	**1.322 [1.206-1.449]**	**1.261 [1.151-1.383]**
French	1.008 [0.968-1.049]	**0.950 [0.912-0.989]**	1.021 [0.937-1.113]	0.954 [0.875-1.039]
Dutch	0.970 [0.936-1.006]	0.974 [0.939-1.009]	1.016 [0.946-1.091]	1.016 [0.946-1.091]
Southern European [c]	**0.894 [0.856-0.933]**	**0.806 [0.772-0.841]**	**0.809 [0.744-0.880]**	**0.728 [0.669-0.792]**
Eastern European [d]	1.014 [0.972-1.058]	0.977 [0.936-1.019]	1.071 [0.976-1.175]	1.004 [0.915-1.102]
Non-western	**0.943 [0.901-0.987]**	**0.826 [0.789-0.865]**	**0.702 [0.642-0.769]**	**0.617 [0.564-0.676]**
Turkish	**1.109 [1.020-1.206]**	0.971 [0.893-1.056]	**0.642 [0.531-0.775]**	**0.570 [0.472-0.689]**
Moroccan	0.957 [0.892-1.026]	**0.805 [0.750-0.864]**	**0.702 [0.614-0.803]**	**0.600 [0.524-0.686]**
	Lung cancer [a,b]		**Breast cancer [a,b]**	
	N = 6,020		**N = 10,795**	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**1.521 [1.386-1.670]**	**1.233 [1.122-1.355]**	**0.826 [0.754-0.906]**	**0.792 [0.722-0.869]**
German	**2.763 [2.270-3.362]**	**2.339 [1.921-2.847]**	1.033 [0.816-1.308]	0.990 [0.781-1.254]
French	**1.696 [1.372-2.097]**	**1.308 [1.057-1.619]**	0.998 [0.816-1.220]	0.942 [0.770-1.152]
Dutch	**1.511 [1.265-1.804]**	**1.519 [1.271-1.815]**	**0.789 [0.658-0.945]**	**0.782 [0.653-0.937]**
Southern European [c]	**0.732 [0.566-0.947]**	**0.496 [0.383-0.643]**	**0.617 [0.499-0.762]**	**0.584 [0.472-0.722]**
Eastern European [d]	**1.734 [1.364-2.204]**	**1.328 [1.044-1.690]**	**0.752 [0.579-0.976]**	**0.710 [0.546-0.921]**
Non-western	**0.540 [0.407-0.717]**	**0.347 [0.261-0.462]**	**0.354 [0.271-0.462]**	**0.332 [0.254-0.434]**
Turkish	**0.383 [0.195-0.753]**	**0.257 [0.131-0.506]**	**0.166 [0.076-0.363]**	**0.159 [0.073-0.347]**
Moroccan	**0.568 [0.377-0.854]**	**0.332 [0.220-0.501]**	**0.321 [0.212-0.486]**	**0.299 [0.197-0.454]**
	Cardiovascular diseases (all) [a,b]		**Ischaemic heart disease [a,b]**	
	N = 98,990		**N = 25,844**	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.972 [0.944-1.001]	**0.961 [0.933-0.990]**	1.018 [0.963-1.077]	1.006 [0.951-1.064]
German	**1.145 [1.058-1.240]**	**1.121 [1.036-1.214]**	1.097 [0.938-1.282]	1.077 [0.921-1.259]
French	0.960 [0.900-1.025]	**0.934 [0.874-0.997]**	0.993 [0.876-1.127]	0.958 [0.844-1.087]
Dutch	0.969 [0.914-1.027]	0.979 [0.923-1.038]	1.057 [0.948-1.179]	1.083 [0.971-1.207]
Southern European [c]	**0.931 [0.868-0.999]**	**0.882 [0.822-0.946]**	0.980 [0.861-1.116]	0.912 [0.801-1.040]
Eastern European [d]	0.978 [0.914-1.047]	0.981 [0.916-1.050]	1.050 [0.922-1.196]	1.049 [0.920-1.195]
Non-western	**1.166 [1.083-1.255]**	**1.086 [1.008-1.170]**	**1.282 [1.124-1.461]**	**1.155 [1.012-1.319]**
Turkish	**1.583 [1.397-1.793]**	**1.463 [1.291-1.658]**	**1.633 [1.298-2.055]**	**1.448 [1.150-1.823]**
Moroccan	**1.206 [1.076-1.352]**	1.080 [0.963-1.212]	**1.553 [1.290-1.869]**	**1.335 [1.108-1.608]**

Table 2.5. (continued)

	Heart failure [a,b]		Cerebrovascular disease [a,b]	
	N = 17,168		N = 25,575	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.874 [0.811-0.942]**	**0.914 [0.848-0.985]**	**0.884 [0.832-0.938]**	**0.885 [0.833-0.940]**
German	0.937 [0.754-1.166]	0.956 [0.769-1.189]	1.046 [0.890-1.228]	1.036 [0.882-1.218]
French	0.862 [0.731-1.017]	0.886 [0.751-1.045]	**0.848 [0.740-0.972]**	**0.840 [0.733-0.963]**
Dutch	1.034 [0.902-1.186]	1.049 [0.914-1.203]	0.906 [0.805-1.019]	0.910 [0.808-1.024]
Southern European [c]	**0.744 [0.608-0.911]**	**0.772 [0.631-0.946]**	**0.807 [0.698-0.935]**	**0.786 [0.679-0.911]**
Eastern European [d]	0.900 [0.762-1.064]	0.973 [0.823-1.150]	**0.850 [0.737-0.982]**	**0.865 [0.749-0.999]**
Non-western	0.841 [0.663-1.067]	0.896 [0.705-1.138]	**1.235 [1.075-1.420]**	**1.197 [1.040-1.376]**
Turkish	1.207 [0.820-1.778]	1.266 [0.860-1.866]	**1.791 [1.426-2.251]**	**1.713 [1.363-2.153]**
Moroccan	0.773 [0.512-1.166]	0.798 [0.528-1.205]	1.077 [0.852-1.361]	1.017 [0.804-1.286]
	Infectious diseases [a,b]		**Respiratory diseases [a,b]**	
	N = 6,586		N = 28,468	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.034 [0.927-1.154]	0.965 [0.864-1.078]	**1.061 [1.007-1.119]**	0.993 [0.942-1.048]
German	0.908 [0.647-1.275]	0.847 [0.603-1.189]	**1.331 [1.159-1.528]**	**1.239 [1.079-1.423]**
French	1.184 [0.941-1.491]	1.082 [0.859-1.363]	**1.139 [1.018-1.275]**	1.040 [0.929-1.164]
Dutch	0.897 [0.710-1.133]	0.903 [0.715-1.141]	0.915 [0.818-1.023]	0.919 [0.822-1.029]
Southern European [c]	1.191 [0.944-1.503]	1.020 [0.807-1.288]	1.006 [0.886-1.141]	**0.857 [0.755-0.974]**
Eastern European [d]	0.984 [0.753-1.287]	0.919 [0.702-1.202]	1.076 [0.952-1.215]	1.015 [0.898-1.147]
Non-western	**1.827 [1.475-2.264]**	**1.499 [1.207-1.862]**	0.977 [0.841-1.135]	**0.799 [0.687-0.929]**
Turkish	**1.581 [1.004-2.488]**	1.317 [0.836-2.076]	**1.304 [1.010-1.683]**	1.077 [0.834-1.391]
Moroccan	**2.160 [1.593-2.928]**	**1.687 [1.242-2.293]**	1.074 [0.857-1.345]	0.824 [0.657-1.033]
	Diabetes-related causes [a,b]		**Alcohol-related causes [a,b]**	
	N = 16,269		N = 2,461	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**1.082 [1.010-1.159]**	**1.077 [1.005-1.154]**	0.936 [0.784-1.118]	**0.759 [0.634-0.909]**
German	1.127 [0.930-1.367]	1.116 [0.920-1.353]	1.059 [0.651-1.722]	0.887 [0.545-1.444]
French	0.987 [0.841-1.159]	0.950 [0.809-1.116]	**1.748 [1.266-2.413]**	1.312 [0.949-1.813]
Dutch	0.947 [0.819-1.096]	0.986 [0.852-1.140]	0.675 [0.453-1.005]	0.673 [0.452-1.001]
Southern European [c]	**1.604 [1.412-1.821]**	**1.472 [1.294-1.674]**	0.669 [0.447-1.002]	**0.485 [0.323-0.728]**
Eastern European [d]	1.080 [0.917-1.272]	1.104 [0.937-1.301]	0.807 [0.467-1.397]	0.604 [0.349-1.046]
Non-western	**2.280 [2.017-2.578]**	**1.972 [1.741-2.234]**	**0.586 [0.395-0.868]**	**0.394 [0.265-0.585]**
Turkish	**2.828 [2.275-3.515]**	**2.375 [1.909-2.955]**	**0.359 [0.130-0.987]**	**0.258 [0.094-0.711]**
Moroccan	**2.676 [2.247-3.187]**	**2.177 [1.824-2.597]**	**0.406 [0.202-0.817]**	**0.262 [0.130-0.528]**

Table 2.5. (continued)

	External causes of death (all) [a,b]		Suicide [a,b]	
	N = 8,199		N = 1,271	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.040 [0.944-1.145]	0.950 [0.862-1.048]	0.991 [0.781-1.259]	0.885 [0.695-1.127]
German	**1.471 [1.160-1.867]**	**1.356 [1.069-1.721]**	1.411 [0.780-2.551]	1.305 [0.721-2.361]
French	**1.392 [1.149-1.687]**	**1.238 [1.021-1.502]**	**2.157 [1.435-3.241]**	**1.843 [1.223-2.778]**
Dutch	0.879 [0.716-1.079]	0.887 [0.722-1.089]	0.751 [0.448-1.260]	0.769 [0.458-1.291]
Southern European [c]	**0.693 [0.537-0.895]**	**0.583 [0.451-0.753]**	**0.400 [0.197-0.814]**	**0.324 [0.159-0.660]**
Eastern European [d]	1.148 [0.913-1.443]	1.028 [0.817-1.293]	1.691 [0.987-2.897]	1.425 [0.830-2.447]
Non-western	**0.662 [0.506-0.865]**	**0.534 [0.408-0.699]**	**0.505 [0.289-0.882]**	**0.390 [0.222-0.684]**
Turkish	0.955 [0.611-1.492]	0.789 [0.505-1.234]	no cases	no cases
Moroccan	**0.437 [0.265-0.721]**	**0.337 [0.204-0.556]**	0.591 [0.276-1.267]	**0.436 [0.202-0.940]**
	Symptoms, signs and ill-defined conditions [a,b]		**Other causes of death [a,b]**	
	N = 7,071		N = 41,627	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.901 [0.803-1.010]	**0.843 [0.751-0.946]**	**0.949 [0.906-0.993]**	**0.891 [0.851-0.932]**
German	0.920 [0.652-1.298]	0.849 [0.602-1.198]	1.011 [0.889-1.151]	0.945 [0.830-1.075]
French	0.866 [0.669-1.122]	0.795 [0.613-1.030]	0.916 [0.826-1.015]	**0.845 [0.762-0.937]**
Dutch	1.039 [0.841-1.283]	1.026 [0.831-1.268]	0.986 [0.902-1.077]	0.983 [0.899-1.074]
Southern European [c]	**0.648 [0.467-0.899]**	**0.569 [0.410-0.790]**	0.924 [0.830-1.029]	**0.806 [0.723-0.898]**
Eastern European [d]	1.006 [0.783-1.292]	0.942 [0.733-1.210]	0.986 [0.888-1.094]	0.928 [0.836-1.031]
Non-western	**0.441 [0.276-0.703]**	**0.381 [0.239-0.609]**	**0.857 [0.752-0.977]**	**0.732 [0.642-0.834]**
Turkish	0.813 [0.415-1.590]	0.722 [0.369-1.413]	0.886 [0.687-1.142]	**0.767 [0.595-0.989]**
Moroccan	**0.258 [0.097-0.687]**	**0.212 [0.080-0.566]**	0.856 [0.696-1.051]	**0.698 [0.568-0.858]**

Data source: Belgian 2001 census linked to National Register (2001-2009)

a. Model 1: Controlling for age; Model 2: Controlling for age, education, housing status, and urban typology

b. In bold, statistically significant ($p < 0.05$)

c. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

d. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Czechoslovakia, former Yugoslavia, and former USSR

symptoms, signs, and ill-defined conditions; and mortality due to other causes of death tended to be lower among male migrants.

The cause-specific mortality differences by migrant origin among older females followed a similar pattern than those of older males. However, some important differences should be noted, especially regarding cancer and cardiovascular

disease. Even after adjusting for socio-economic status, overall cancer mortality tended to be higher among female western migrants, mainly due to a large mortality disadvantage in lung cancer mortality (1.233, 1.122–1.355). Similarly, even after controlling for socio-economic status, overall cardiovascular disease mortality was higher among German (1.121, 1.036–1.214) and non-western female migrants, especially among females of Turkish origin (1.463, 1.291–1.658); this pattern was also visible when we examined mortality due to ischaemic heart disease and cerebrovascular disease. Suicide (1.843, 1.223–2.778) was very high among French female migrants.

2.4 DISCUSSION

At older ages, both western and non-western migrants had an all-cause mortality advantage relative to non-migrants, despite generally having a lower socio-economic status. However, migrants had higher mortality from infectious diseases, diabetes-related causes, respiratory diseases (western migrants), cardiovascular diseases (non-western female migrants), and lung cancer (western female migrants).

2.4.1 Explanation of the observed results

The overall mortality advantage of most migrant groups was mainly due to lower mortality risks for most causes of death, especially cancer and cardiovascular disease. Older migrants' mortality advantages in chronic diseases may be explained by a number of factors. Migrants, especially those of non-western origin, tend to have a healthier lifestyle, including a healthier diet (Darmon & Khlat, 2001), and lower levels of alcohol and tobacco consumption (Abraído-Lanza et al., 2005). Even though migrants may adopt unhealthy behaviours from the host society, chronic conditions often have long latency periods (Law & Wald, 1999; Razum & Twardella, 2002), and are related to life-long cumulative risk behaviours (Reinikainen et al., 2015). Furthermore, migrant networks and families may help migrants cope with the challenges involved in migration (de Valk et al., 2011), which could be protective against the negative effects of low socio-economic status on mortality. The exceptionally low levels of mortality due to suicide, alcohol-related causes, and lung cancer (females only) among Turkish and Moroccan migrants are likely attributable to health-related behaviours shaped by cultural and religious factors (Deboosere & Gadeyne, 2005).

However, we also found that migrants had mortality disadvantages for specific diseases. Older migrants, especially those of non-western origin (including Moroccans and Turks), had higher mortality than non-migrants from infectious diseases and diabetes-related causes, which is in line with previous results focusing on people aged 25–54 (Deboosere & Gadeyne, 2005; Vandenheede et al., 2015). The excess mortality from infectious diseases among non-western migrants at the time of migration may reflect the mortality pattern in the regions of origin (Razum & Twardella, 2002). However, at older ages this could be the result of higher levels of deprivation (Deboosere & Gadeyne, 2005) and less use of preventive health services (Nørredam & Krasnik, 2011). Although both diabetes-related and cardiovascular disease mortalities are associated with obesity, the risk of diabetes-related mortality seems to increase shortly after the adoption of obesity-related behaviours, while cardiovascular diseases often have long latency periods (Vandenheede et al., 2015). The higher respiratory disease mortality risk observed among southern European male migrants could be related to the fact that many of them worked in heavy metal and mining industries (Phalet & Swyngedouw, 2003).

Among females, non-western migrants had higher levels of cardiovascular disease mortality, and western migrants (except southern Europeans) had higher levels of lung cancer mortality, as compared to non-migrants. These patterns of mortality disadvantage were not found among males. The high cardiovascular mortality risk of non-western female migrants (including Moroccan and Turks) may be partly attributable to their lower mortality risk from other chronic diseases. However, obesity, one of the risk factors for cardiovascular disease (Flegal et al., 2007), is highly prevalent among non-western female migrants, both in their countries of origin (Martorell et al., 2000) and in Europe (Deboosere & Gadeyne, 2005; Agyemang et al., 2009). Lung cancer mortality is highly associated with smoking (Peto et al., 1992). Although the contribution of lung cancer mortality to all-cause mortality among western female migrants was small, smoking rates among females are expected to increase further (Janssen & Spriensma, 2012).

In line with previous studies on mortality differences between migrants and non-migrants in Belgium at ages 25–54 (Deboosere & Gadeyne, 2005; Vandenheede et al., 2015) and 10–29 (de Grande & Vandenheede, 2014), our study shows that older migrants tend to have a mortality advantage over non-migrants, many years after migration (75% of older migrants have been living in Belgium for more than 20 years). Whereas among the younger population mortality differences by migrant origin were to a large extent determined by external and alcohol-related

causes, mortality differences at older ages were mainly attributable to chronic diseases. The cardiovascular mortality disadvantage among non-western female migrants and the lung cancer mortality disadvantage among western female migrants were only visible at older ages, possibly due to the difference in time between the adoption of risk profiles and their effects on mortality (Razum & Twardella, 2002).

Migrants often have a lower socio-economic status than non-migrants, and socio-economic status is inversely associated with mortality (Razum et al., 1998; Abraído-Lanza et al., 1999; Palloni & Arias, 2004). Our study confirms this association, as controlling for socio-economic status tended to increase migrants' mortality advantage. For specific causes of death or among specific origin groups, migrants' mortality disadvantages were, at least partially, attributable to socio-economic status. For instance, higher mortality risks due to alcohol-related causes and suicide among French migrants were largely explained by socio-economic status; French migrants in Belgium originate mostly from poorer regions in France, and tend to reside in more deprived neighbourhoods (Deboosere & Gadeyne, 2005).

2.4.2 Evaluation of the data and methods

Despite using high quality census and register data, some methodological issues warrant attention. First of all, given that the age-specific mortality rates of migrants cross over with those of non-migrants, the choice of a 'younger' or an 'older' standard population can affect the comparability of ASMR. We performed a sensitivity analysis with the WHO World Standard Population 2000–2025 as the standard; the comparison of the ASMR of migrants and non-migrants led to the same conclusions.

Because the cause of death was unknown for more than 20% of non-western migrants who died during the follow-up period, we ran weighted Poisson regression models. Weighted results can be regarded as more accurate than unweighted results, which are artificially lowered, especially in the case of non-western migrants. However, when using ratio weights based on a large number of strata, there is a chance that weights cannot be defined for certain unlinked cases (Fawcett et al., 2002). Stratifying the deceased by age, sex, nationality at birth, education, and urban typology of the area of residence reduced undefined weights to only 36 cases (less than 0.5% in every migrant origin group, results not shown), and hence to a minor fraction of the population-based data.

Even when controlling for socio-economic status, a residual effect of socio-economic status on mortality could remain unexplained, as migrants may be in a more deprived situation than non-migrants in a similar socio-economic position (Nazroo, 1998). We believe this effect was minimised, as we controlled for two different dimensions of socio-economic status (Adler et al., 1994), which reflected both the current socio-economic status (housing quality) and the socio-economic status during childhood and youth (education), (Bhopal et al., 2002).

Finally, due to data limitations, we excluded from our study people living in the Walloon Region. Although the population of Wallonia tend to have worse mortality outcomes than the population of Flanders (van Oyen et al., 1996), historic patterns of migration are similar throughout Belgium (de Valk et al., 2011). Furthermore, the patterns in the mortality differences between older migrants and non-migrants found in our study are largely in line with those found in earlier studies for the entire Belgian population aged 25–54 (Deboosere & Gadeyne, 2005; Vandenheede et al., 2015). Therefore, the results of our study can be regarded as generalisable to the whole country.

2.5 OVERALL CONCLUSION

Mortality differences between older migrants and non-migrants are highly dependent on cause of death, age, sex, origin, and socio-economic status. Despite generally having a lower socio-economic position, the tendencies of migrants to have healthier diets, and lower levels of alcohol and tobacco consumption, and strong family and migrant networks might explain the overall migrant mortality advantage over non-migrants. However, lower use of preventive services and higher rates of obesity and smoking may explain the mortality disadvantages of specific migrant groups in some causes of death, some of which arose only at older ages.

As Belgium is among the first of the European countries to make the transition to being an older and more multicultural society, the results of our study are relevant for policies in Belgium and in other countries facing similar challenges. Policies aimed at reducing mortality inequalities between migrants and non-migrants should address the specific health needs of various groups based on country or region of origin, socio-economic status, and age.

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SUPPLEMENT CHAPTER 2

Table 2.S.1. Unweighted cause-specific mortality rate ratios with 95% confidence intervals for male migrants compared to non-migrants (reference) aged 50+ over the period 2001-2009 (Flanders and Brussels-Capital Region)

	Unlinked cases [a,b]		Cancer (all) [a,b]	
	N = 5,163		N = 76,945	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**4.301 [3.989-4.637]**	**3.250 [3.008-3.511]**	**0.888 [0.858-0.919]**	**0.852 [0.823-0.883]**
German	**3.026 [2.159-4.243]**	**2.272 [1.619-3.186]**	0.889 [0.773-1.023]	0.892 [0.775-1.026]
French	**4.255 [3.510-5.158]**	**3.073 [2.532-3.729]**	1.040 [0.952-1.136]	0.970 [0.888-1.059]
Dutch	**2.777 [2.373-3.251]**	**2.596 [2.216-3.041]**	**0.889 [0.835-0.946]**	**0.928 [0.872-0.987]**
Southern European [c]	**6.166 [5.523-6.883]**	**4.362 [3.890-4.891]**	**0.821 [0.770-0.876]**	**0.722 [0.676-0.771]**
Eastern European [d]	**4.993 [4.140-6.021]**	**3.293 [2.727-3.978]**	**0.886 [0.802-0.979]**	**0.836 [0.756-0.924]**
Non-western	**8.786 [8.058-9.581]**	**5.594 [5.096-6.140]**	**0.653 [0.611-0.697]**	**0.554 [0.519-0.592]**
Turkish	**13.65 [11.82-15.76]**	**10.40 [8.959-12.07]**	**0.787 [0.692-0.896]**	**0.659 [0.579-0.751]**
Moroccan	**9.304 [8.313-10.41]**	**6.219 [5.513-7.016]**	**0.626 [0.571-0.686]**	**0.513 [0.468-0.563]**
	Lung cancer [a,b]		**Prostate cancer [a,b]**	
	N = 24,986		N = 7,958	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.849 [0.799-0.903]**	**0.815 [0.766-0.868]**	**0.819 [0.730-0.919]**	**0.796 [0.709-0.894]**
German	**0.749 [0.576-0.974]**	0.778 [0.598-1.011]	0.980 [0.625-1.537]	0.964 [0.615-1.513]
French	0.958 [0.816-1.125]	0.880 [0.749-1.034]	1.047 [0.792-1.382]	1.005 [0.761-1.327]
Dutch	**0.837 [0.749-0.936]**	0.912 [0.815-1.020]	0.883 [0.725-1.076]	0.897 [0.736-1.093]
Southern European [c]	**0.837 [0.750-0.934]**	**0.701 [0.627-0.783]**	**0.499 [0.375-0.662]**	**0.464 [0.349-0.617]**
Eastern European [d]	0.976 [0.822-1.158]	0.928 [0.782-1.102]	0.943 [0.710-1.253]	0.899 [0.677-1.196]
Non-western	**0.723 [0.651-0.802]**	**0.578 [0.520-0.642]**	**0.646 [0.506-0.823]**	**0.588 [0.460-0.751]**
Turkish	0.948 [0.778-1.155]	**0.728 [0.597-0.888]**	0.684 [0.405-1.155]	0.622 [0.368-1.052]
Moroccan	**0.723 [0.626-0.834]**	**0.547 [0.473-0.632]**	**0.640 [0.457-0.897]**	**0.572 [0.407-0.803]**
	Cardiovascular diseases (all) [a,b]		**Ischaemic heart disease [a,b]**	
	N = 80,037		N = 31,088	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.861 [0.831-0.892]**	**0.834 [0.805-0.864]**	**0.885 [0.837-0.935]**	**0.862 [0.815-0.911]**
German	1.051 [0.918-1.203]	1.063 [0.928-1.217]	1.150 [0.940-1.409]	1.176 [0.960-1.440]
French	1.001 [0.916-1.094]	0.943 [0.863-1.030]	0.979 [0.848-1.130]	0.920 [0.797-1.062]
Dutch	**0.832 [0.780-0.887]**	**0.865 [0.811-0.922]**	**0.846 [0.764-0.936]**	**0.888 [0.802-0.983]**
Southern European [c]	**0.774 [0.721-0.831]**	**0.687 [0.640-0.738]**	**0.838 [0.754-0.932]**	**0.746 [0.670-0.831]**
Eastern European [d]	0.986 [0.903-1.077]	0.945 [0.865-1.032]	1.002 [0.869-1.156]	0.967 [0.838-1.116]
Non-western	**0.723 [0.674-0.776]**	**0.616 [0.574-0.661]**	**0.748 [0.674-0.831]**	**0.638 [0.574-0.710]**
Turkish	0.899 [0.782-1.034]	**0.753 [0.655-0.865]**	1.040 [0.854-1.266]	0.866 [0.711-1.055]
Moroccan	**0.668 [0.604-0.739]**	**0.551 [0.498-0.610]**	**0.695 [0.598-0.808]**	**0.574 [0.493-0.668]**

Table 2.S.1. (continued)

	Heart failure [a,b]		Cerebrovascular disease [a,b]	
	N = 9,341		N = 16,620	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.762 [0.682-0.852]**	**0.767 [0.685-0.857]**	**0.843 [0.779-0.912]**	**0.829 [0.765-0.897]**
German	0.587 [0.333-1.034]	0.618 [0.351-1.089]	0.842 [0.601-1.178]	0.860 [0.614-1.204]
French	1.210 [0.955-1.533]	1.197 [0.944-1.517]	0.974 [0.798-1.188]	0.939 [0.770-1.146]
Dutch	**0.746 [0.612-0.909]**	**0.775 [0.635-0.945]**	**0.748 [0.644-0.867]**	**0.772 [0.665-0.896]**
Southern European [c]	**0.590 [0.455-0.766]**	**0.550 [0.423-0.715]**	**0.828 [0.710-0.965]**	**0.759 [0.650-0.886]**
Eastern European [d]	0.779 [0.592-1.026]	0.790 [0.599-1.041]	0.982 [0.811-1.190]	0.963 [0.794-1.167]
Non-western	**0.511 [0.383-0.681]**	**0.465 [0.349-0.621]**	0.883 [0.764-1.020]	**0.783 [0.676-0.906]**
Turkish	0.694 [0.394-1.223]	0.614 [0.348-1.082]	0.997 [0.736-1.350]	0.867 [0.640-1.175]
Moroccan	**0.414 [0.264-0.650]**	**0.366 [0.233-0.574]**	**0.809 [0.655-0.997]**	**0.701 [0.567-0.866]**
	Infectious diseases [a,b]		**Respiratory diseases [a,b]**	
	N = 4,898		N = 33,130	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.076 [0.946-1.225]	0.964 [0.846-1.098]	1.028 [0.977-1.082]	0.987 [0.937-1.039]
German	1.400 [0.869-2.254]	1.328 [0.825-2.140]	0.960 [0.766-1.205]	1.002 [0.799-1.257]
French	1.253 [0.906-1.731]	1.091 [0.789-1.509]	1.014 [0.882-1.165]	0.944 [0.821-1.085]
Dutch	0.828 [0.638-1.075]	0.860 [0.662-1.118]	**0.775 [0.698-0.859]**	**0.840 [0.757-0.932]**
Southern European [c]	1.088 [0.853-1.387]	0.858 [0.671-1.096]	**1.335 [1.223-1.457]**	**1.101 [1.008-1.203]**
Eastern European [d]	1.296 [0.946-1.777]	1.102 [0.803-1.513]	**1.181 [1.044-1.337]**	1.116 [0.985-1.263]
Non-western	**1.381 [1.124-1.698]**	1.019 [0.826-1.257]	**0.699 [0.621-0.786]**	**0.540 [0.479-0.608]**
Turkish	0.961 [0.557-1.657]	0.719 [0.416-1.241]	0.962 [0.768-1.206]	**0.723 [0.577-0.906]**
Moroccan	1.245 [0.921-1.683]	0.883 [0.651-1.197]	**0.629 [0.529-0.748]**	**0.462 [0.388-0.550]**
	Diabetes-related causes [a,b]		**Alcohol-related causes [a,b]**	
	N = 11,849		N = 5,241	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.072 [0.986-1.164]	0.957 [0.880-1.041]	0.957 [0.848-1.080]	**0.717 [0.634-0.810]**
German	0.824 [0.556-1.220]	0.791 [0.534-1.171]	1.261 [0.837-1.900]	0.981 [0.651-1.479]
French	**1.308 [1.065-1.606]**	1.122 [0.913-1.378]	**1.908 [1.514-2.404]**	**1.267 [1.004-1.599]**
Dutch	**0.672 [0.558-0.810]**	**0.710 [0.589-0.855]**	**0.533 [0.397-0.715]**	**0.536 [0.400-0.720]**
Southern European [c]	**1.543 [1.356-1.755]**	**1.198 [1.051-1.365]**	**0.696 [0.545-0.889]**	**0.457 [0.357-0.585]**
Eastern European [d]	**1.244 [1.007-1.536]**	1.063 [0.860-1.313]	**1.495 [1.095-2.041]**	1.005 [0.735-1.374]
Non-western	**1.666 [1.482-1.872]**	**1.187 [1.053-1.337]**	**0.273 [0.198-0.377]**	**0.163 [0.118-0.226]**
Turkish	**1.924 [1.518-2.439]**	**1.387 [1.093-1.760]**	**0.212 [0.095-0.472]**	**0.137 [0.062-0.306]**
Moroccan	**1.570 [1.331-1.851]**	1.081 [0.915-1.279]	**0.117 [0.058-0.234]**	**0.068 [0.034-0.137]**

Table 2.S.1. (continued)

	External causes of death (all) [a,b]		Suicide [a,b]	
	N = 8,567		N = 2,560	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.828 [0.746-0.920]**	**0.761 [0.684-0.846]**	**0.648 [0.526-0.798]**	**0.599 [0.486-0.740]**
German	1.028 [0.699-1.511]	0.988 [0.672-1.453]	1.044 [0.543-2.010]	1.015 [0.527-1.954]
French	0.942 [0.722-1.228]	0.820 [0.628-1.069]	0.899 [0.558-1.448]	0.785 [0.487-1.267]
Dutch	**0.758 [0.621-0.924]**	**0.797 [0.653-0.972]**	**0.605 [0.408-0.898]**	**0.636 [0.429-0.944]**
Southern European [c]	**0.728 [0.594-0.894]**	**0.597 [0.485-0.733]**	**0.542 [0.363-0.811]**	**0.450 [0.300-0.675]**
Eastern European [d]	1.057 [0.807-1.385]	0.939 [0.716-1.232]	0.712 [0.382-1.325]	0.652 [0.350-1.216]
Non-western	**0.510 [0.412-0.632]**	**0.395 [0.318-0.491]**	**0.207 [0.120-0.357]**	**0.163 [0.094-0.281]**
Turkish	**0.525 [0.331-0.834]**	**0.405 [0.255-0.645]**	**0.153 [0.038-0.611]**	**0.117 [0.029-0.468]**
Moroccan	**0.513 [0.380-0.693]**	**0.382 [0.283-0.517]**	**0.128 [0.048-0.341]**	**0.096 [0.036-0.257]**
	Symptoms, signs and ill-defined conditions [a,b]		**Other causes of death [a,b]**	
	N = 4,134		N = 25,432	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.934 [0.805-1.084]	**0.798 [0.687-0.927]**	**0.883 [0.830-0.940]**	**0.825 [0.775-0.878]**
German	0.773 [0.386-1.547]	0.701 [0.350-1.403]	0.762 [0.572-1.014]	**0.737 [0.554-0.982]**
French	1.275 [0.905-1.796]	1.043 [0.740-1.471]	1.063 [0.912-1.239]	0.976 [0.837-1.138]
Dutch	0.764 [0.571-1.022]	0.800 [0.598-1.070]	0.899 [0.806-1.003]	0.915 [0.820-1.021]
Southern European [c]	0.844 [0.625-1.140]	**0.603 [0.446-0.817]**	**0.805 [0.710-0.913]**	**0.687 [0.605-0.780]**
Eastern European [d]	1.184 [0.832-1.687]	0.949 [0.666-1.353]	0.932 [0.795-1.092]	**0.841 [0.717-0.987]**
Non-western	0.836 [0.630-1.109]	**0.542 [0.407-0.721]**	**0.725 [0.638-0.825]**	**0.597 [0.524-0.680]**
Turkish	0.598 [0.285-1.257]	**0.400 [0.190-0.841]**	0.776 [0.588-1.024]	**0.639 [0.484-0.844]**
Moroccan	0.879 [0.597-1.294]	**0.541 [0.367-0.799]**	**0.652 [0.540-0.788]**	**0.521 [0.430-0.630]**

Data source: Belgian 2001 census linked to National Register (2001-2009)

a. Model 1: Controlling for age; Model 2: Controlling for age, education, housing status, and urban typology

b. In bold, statistically significant ($p < 0.05$)

c. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

d. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Czechoslovakia, former Yugoslavia, and former USSR

Table 2.S.2. Unweighted cause-specific mortality rate ratios with 95% confidence intervals for female migrants compared to non-migrants (reference) aged 50+ over the period 2001–2009 (Flanders and Brussels-Capital Region)

	Unlinked cases [a,b]		Cancer (all) [a,b]	
	N = 4,888		N = 57,472	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**3.087 [2.837-3.360]**	**2.380 [2.185-2.594]**	0.975 [0.939-1.013]	**0.929 [0.894-0.965]**
German	**1.785 [1.312-2.428]**	**1.414 [1.039-1.924]**	**1.305 [1.189-1.432]**	**1.250 [1.139-1.372]**
French	**3.110 [2.589-3.735]**	**2.322 [1.931-2.790]**	0.978 [0.896-1.069]	0.918 [0.840-1.003]
Dutch	**1.726 [1.394-2.138]**	**1.667 [1.346-2.065]**	0.998 [0.928-1.073]	0.999 [0.929-1.074]
Southern European [c]	**5.349 [4.654-6.147]**	**3.741 [3.246-4.312]**	**0.739 [0.676-0.807]**	**0.669 [0.612-0.731]**
Eastern European [d]	**3.690 [3.079-4.423]**	**2.668 [2.224-3.200]**	1.025 [0.931-1.128]	0.967 [0.878-1.064]
Non-western	**11.75 [10.56-13.08]**	**7.678 [6.865-8.587]**	**0.574 [0.519-0.635]**	**0.508 [0.459-0.563]**
Turkish	**15.51 [12.99-18.53]**	**11.73 [9.786-14.06]**	**0.496 [0.399-0.616]**	**0.441 [0.355-0.548]**
Moroccan	**14.33 [12.40-16.57]**	**9.439 [8.113-10.98]**	**0.549 [0.471-0.640]**	**0.472 [0.404-0.551]**
	Lung cancer [a,b]		**Breast cancer [a,b]**	
	N = 6,020		N = 10,795	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**1.464 [1.330-1.611]**	**1.191 [1.081-1.313]**	**0.797 [0.726-0.876]**	**0.768 [0.699-0.844]**
German	**2.713 [2.222-3.313]**	**2.305 [1.887-2.816]**	1.032 [0.813-1.310]	0.992 [0.782-1.260]
French	**1.632 [1.312-2.029]**	**1.265 [1.016-1.574]**	0.961 [0.782-1.182]	0.912 [0.742-1.122]
Dutch	**1.481 [1.236-1.774]**	**1.489 [1.242-1.785]**	**0.776 [0.646-0.933]**	**0.769 [0.640-0.925]**
Southern European [c]	**0.675 [0.515-0.884]**	**0.459 [0.350-0.603]**	**0.564 [0.451-0.705]**	**0.537 [0.429-0.672]**
Eastern European [d]	**1.649 [1.286-2.114]**	1.270 [0.989-1.629]	**0.714 [0.545-0.936]**	**0.678 [0.518-0.889]**
Non-western	**0.444 [0.324-0.609]**	**0.287 [0.209-0.394]**	**0.291 [0.216-0.391]**	**0.275 [0.204-0.370]**
Turkish	**0.278 [0.125-0.619]**	**0.187 [0.084-0.416]**	**0.134 [0.056-0.323]**	**0.129 [0.054-0.310]**
Moroccan	**0.450 [0.283-0.714]**	**0.264 [0.166-0.421]**	**0.249 [0.155-0.400]**	**0.234 [0.145-0.376]**
	Cardiovascular diseases (all) [a,b]		**Ischaemic heart disease [a,b]**	
	N = 98,990		N = 25,844	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.940 [0.912-0.968]**	**0.934 [0.906-0.963]**	0.982 [0.927-1.040]	0.975 [0.920-1.033]
German	**1.137 [1.050-1.232]**	**1.118 [1.032-1.212]**	1.086 [0.927-1.272]	1.071 [0.914-1.254]
French	**0.928 [0.868-0.993]**	**0.907 [0.848-0.969]**	0.960 [0.844-1.093]	0.930 [0.818-1.059]
Dutch	0.959 [0.904-1.017]	0.969 [0.914-1.028]	1.046 [0.936-1.167]	1.072 [0.960-1.197]
Southern European [c]	**0.854 [0.793-0.919]**	**0.813 [0.755-0.876]**	0.898 [0.783-1.030]	**0.842 [0.733-0.966]**
Eastern European [d]	0.940 [0.876-1.008]	0.948 [0.884-1.017]	1.003 [0.877-1.147]	1.007 [0.881-1.153]
Non-western	0.920 [0.846-1.001]	**0.864 [0.795-0.940]**	1.006 [0.867-1.168]	0.916 [0.788-1.064]
Turkish	**1.226 [1.062-1.414]**	1.137 [0.985-1.312]	1.274 [0.980-1.656]	1.133 [0.871-1.474]
Moroccan	0.900 [0.787-1.028]	**0.813 [0.711-0.929]**	1.149 [0.924-1.427]	0.996 [0.801-1.239]

Table 2.S.2. (continued)

	Heart failure [a,b]		Cerebrovascular disease [a,b]	
	N = 17,168		N = 25,575	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.850 [0.787-0.917]**	**0.893 [0.827-0.964]**	**0.855 [0.804-0.909]**	**0.860 [0.809-0.915]**
German	0.937 [0.752-1.168]	0.961 [0.771-1.197]	1.040 [0.884-1.224]	1.035 [0.879-1.218]
French	**0.835 [0.705-0.987]**	0.861 [0.727-1.019]	**0.820 [0.714-0.943]**	**0.816 [0.710-0.938]**
Dutch	1.026 [0.893-1.178]	1.041 [0.907-1.196]	0.893 [0.792-1.007]	0.898 [0.797-1.013]
Southern European [c]	**0.685 [0.554-0.846]**	**0.715 [0.578-0.885]**	**0.739 [0.633-0.862]**	**0.724 [0.620-0.845]**
Eastern European [d]	0.869 [0.732-1.031]	0.945 [0.796-1.122]	**0.816 [0.704-0.946]**	**0.835 [0.721-0.968]**
Non-western	**0.677 [0.518-0.885]**	**0.728 [0.557-0.953]**	0.947 [0.807-1.111]	0.925 [0.787-1.086]
Turkish	1.009 [0.657-1.548]	1.062 [0.692-1.631]	1.307 [0.998-1.711]	1.254 [0.957-1.644]
Moroccan	**0.591 [0.367-0.951]**	**0.616 [0.382-0.992]**	0.777 [0.589-1.026]	**0.740 [0.560-0.978]**
	Infectious diseases [a,b]		**Respiratory diseases [a,b]**	
	N = 6,586		N = 28,468	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	0.996 [0.889-1.114]	0.934 [0.833-1.046]	1.026 [0.972-1.083]	0.966 [0.915-1.019]
German	0.909 [0.645-1.280]	0.851 [0.604-1.199]	**1.323 [1.151-1.522]**	**1.238 [1.076-1.424]**
French	1.144 [0.904-1.448]	1.051 [0.830-1.331]	1.100 [0.980-1.234]	1.008 [0.898-1.132]
Dutch	0.885 [0.698-1.122]	0.892 [0.703-1.131]	0.904 [0.807-1.013]	0.910 [0.812-1.019]
Southern European [c]	1.092 [0.855-1.395]	0.941 [0.736-1.204]	0.922 [0.807-1.053]	**0.791 [0.692-0.904]**
Eastern European [d]	0.946 [0.718-1.246]	0.889 [0.674-1.171]	1.034 [0.912-1.172]	0.981 [0.866-1.113]
Non-western	**1.455 [1.142-1.853]**	1.205 [0.944-1.538]	**0.800 [0.677-0.945]**	**0.661 [0.559-0.781]**
Turkish	1.204 [0.712-2.035]	1.008 [0.596-1.706]	1.057 [0.793-1.407]	0.877 [0.658-1.168]
Moroccan	**1.676 [1.183-2.375]**	1.321 [0.931-1.876]	0.836 [0.646-1.082]	**0.647 [0.500-0.838]**
	Diabetes-related causes [a,b]		**Alcohol-related causes [a,b]**	
	N = 16,269		N = 2,461	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.038 [0.967-1.113]	1.038 [0.967-1.114]	0.893 [0.743-1.073]	**0.727 [0.604-0.875]**
German	1.119 [0.921-1.359]	1.111 [0.914-1.350]	1.056 [0.646-1.727]	0.888 [0.543-1.453]
French	0.952 [0.808-1.122]	0.920 [0.780-1.084]	**1.657 [1.187-2.314]**	1.250 [0.894-1.748]
Dutch	0.939 [0.811-1.088]	0.978 [0.844-1.133]	**0.645 [0.428-0.973]**	**0.643 [0.426-0.970]**
Southern European [c]	**1.476 [1.292-1.687]**	**1.365 [1.193-1.562]**	**0.602 [0.392-0.926]**	**0.439 [0.285-0.676]**
Eastern European [d]	1.026 [0.867-1.215]	1.055 [0.891-1.250]	0.767 [0.435-1.353]	0.577 [0.327-1.019]
Non-western	**1.823 [1.588-2.093]**	**1.594 [1.386-1.833]**	**0.475 [0.305-0.737]**	**0.320 [0.206-0.500]**
Turkish	**2.215 [1.729-2.838]**	**1.868 [1.456-2.395]**	**0.293 [0.094-0.909]**	**0.211 [0.068-0.656]**
Moroccan	**2.047 [1.673-2.503]**	**1.682 [1.373-2.061]**	**0.314 [0.141-0.700]**	**0.204 [0.091-0.456]**

Table 2.S.2. (continued)

	External causes of death (all) [a,b]		Suicide [a,b]	
	N = 8,199		N = 1,271	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	1.006 [0.911-1.110]	0.924 [0.836-1.021]	0.948 [0.741-1.213]	0.850 [0.663-1.091]
German	**1.464 [1.151-1.862]**	**1.356 [1.065-1.725]**	1.428 [0.789-2.587]	1.326 [0.732-2.404]
French	**1.337 [1.098-1.629]**	1.196 [0.981-1.458]	**2.044 [1.341-3.117]**	**1.758 [1.150-2.688]**
Dutch	0.869 [0.706-1.070]	0.878 [0.713-1.081]	0.736 [0.435-1.247]	0.753 [0.444-1.277]
Southern European [c]	**0.639 [0.489-0.835]**	**0.541 [0.413-0.707]**	**0.371 [0.177-0.781]**	**0.302 [0.143-0.637]**
Eastern European [d]	1.087 [0.858-1.378]	0.980 [0.773-1.243]	1.540 [0.872-2.720]	1.306 [0.738-2.313]
Non-western	**0.536 [0.397-0.724]**	**0.435 [0.322-0.589]**	**0.411 [0.220-0.766]**	**0.318 [0.170-0.597]**
Turkish	0.704 [0.417-1.190]	**0.584 [0.345-0.987]**	no cases	no cases
Moroccan	**0.347 [0.197-0.611]**	**0.269 [0.152-0.474]**	0.452 [0.188-1.088]	**0.335 [0.138-0.811]**
	Symptoms, signs and ill-defined conditions [a,b]		**Other causes of death [a,b]**	
	N = 7,071		N = 41,627	
Origin group	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Western	**0.876 [0.779-0.984]**	**0.824 [0.732-0.926]**	**0.917 [0.875-0.960]**	**0.865 [0.825-0.907]**
German	0.919 [0.649-1.301]	0.853 [0.602-1.207]	1.008 [0.884-1.148]	0.946 [0.830-1.077]
French	0.818 [0.625-1.069]	**0.754 [0.577-0.986]**	**0.883 [0.795-0.982]**	**0.819 [0.737-0.910]**
Dutch	1.038 [0.839-1.284]	1.026 [0.829-1.270]	0.974 [0.890-1.066]	0.972 [0.888-1.064]
Southern European [c]	**0.602 [0.428-0.848]**	**0.532 [0.378-0.750]**	**0.849 [0.758-0.951]**	**0.745 [0.665-0.835]**
Eastern European [d]	0.974 [0.754-1.258]	0.918 [0.710-1.187]	0.948 [0.851-1.055]	0.898 [0.806-1.000]
Non-western	**0.380 [0.229-0.631]**	**0.332 [0.200-0.552]**	**0.706 [0.611-0.817]**	**0.608 [0.526-0.704]**
Turkish	0.681 [0.325-1.430]	0.608 [0.289-1.276]	**0.711 [0.534-0.947]**	**0.618 [0.464-0.824]**
Moroccan	**0.198 [0.064-0.613]**	**0.164 [0.053-0.510]**	**0.642 [0.505-0.817]**	**0.528 [0.415-0.672]**

Data source: Belgian 2001 census linked to National Register (2001-2009)

a. Model 1: Controlling for age; Model 2: Controlling for age, education, housing status, and urban typology

b. In bold, statistically significant ($p < 0.05$)

c. Southern European include migrants from Portugal, Spain, Italy, Malta, Greece, and Cyprus

d. Eastern European include migrants from Poland, Hungary, Romania, Bulgaria, Albania, former Czechoslovakia, former Yugoslavia, and former USSR